Civil Society in Times of Crisis: Understanding Collective Action Dynamics in Digitally-Enabled Volunteer Networks

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Abstract

Digital technologies and especially social media play an important role in political mobilization. Although research has explored the use of Twitter by decentralized individuals for collective action organization, there has been little emphasis on its use for voluntary engagement and its broader societal consequences. Using data at both the network and individual level, this study empirically investigates how a digitally-enabled voluntary group emerged and transitioned within the collective action space across time, illustrating how digital technology affected the dynamics of its development. It provides insights related to both the network's communication logic and its participants' experiences, offering one of the first contributions on how individuals can organize solidarity groups that can offer long-term public service under conditions of institutional collapse.

Keywords: social media, Twitter, civic engagement, volunteerism, civil society, social networks

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In the last two decades, scholars and campaign specialists have been intrigued by the shifts in the nature of organizing collective action, and of organizations themselves (Miles & Snow, 1986; Nohria & Berkeley, 1994; Powell, 1990). Such developments have been marked by processes that involve an oftentimes radical departure from bureaucratic organizations with formal, centralized leadership, specific roles and the strategic deployment of resources, to more networked structures with less constraints and rules of action, and an emphasis on self-organization (Powell, 1990). More recently, interest in these changes has been compounded by the rapid advance of information and communication technologies (ICTs) and the changes in the organization of information production in the early 2000s (Benkler, 2006; Bimber, Stohl, & Flanagin, 2009; Lupia & Sin, 2003). Theoretical illustrations of these changes have taken into consideration the entire spectrum of organizational change (Bennett & Segerberg, 2013; Bimber, Flanagin, & Stohl, 2012; Chadwick, 2007; Karpf, 2012; Shirky, 2008), and conceptualizations have been proposed with regards to the impact of technology on political action repertoires (Van Laer & Van Aelst, 2010), as well as on the contemporary collective action space as a whole (Flanagin, Stohl, & Bimber, 2006).

The crux of these accounts is that technology has affected processes of collection action organization in ways that are often more complex than the transition from bureaucratic to flexible organizational structures. Especially the impact of social media platforms with diverse affordances has created interesting empirical questions about the ways in which these

tools enable individuals not only to organize, but also to create complex, polymorphous, and multidimensional organizations. Although the nature of such organizations is hard to place in the broader collective action space, they play an increasingly prominent role in societies.

Whilst recent mobilizations have provided scholars with ample material for empirically studying the dynamics of digitally-boosted and digitally-enabled protest action organization (Barberá et al., 2015; Bastos, Mercea, & Charpentier, 2015; Conover, Ferrara, Menczer, & Flammini, 2013; González-Bailón, Borge-Holthoefer, Rivero, & Moreno, 2011; Theocharis, Lowe, van Deth, & García Albacete, 2015), research has overlooked other important domains. Little attention has been given to the domain of civil society, whereby the multiple and novel ways for voluntary engagement for the provision of public goods or public services and community problem-solving has also been re-shaped by the new opportunities for organizing action digitally (Wells 2014, 616). Voluntary engagement in solidarity initiatives characterized by a reliance on social media and cooperative action through non-market and non-institutional mechanisms, became particularly prominent in several parts of Europe since the onset of the financial crisis, and nowadays play a much greater role in civil society than they used to (see Sotiropoulos, 2015). Although the crucial societal role of such initiatives has often attracted the attention of mainstream media (Henley, 2012a), no studies have empirically illustrated how they emerge, organize, and transition within the broader collective action space, and how they compare to existing paradigms in the (digital) protest literature.

The present study addresses this question by investigating the pioneering solidarity initiative **#tutorpool** which arose in Greece during one of the most turbulent periods in its modern history. It traces its emergence, and tracks its pathway across the collective action space (Flanagin et al., 2006), illustrating how technology affected the dynamics of its development. Advancing empirical studies that focus either only on the structural (González-Bailón & Wang, 2015) or only on the individual level (Penney & Dadas, 2014), this study provides

insights related to both the network's communication logic *and* its participants' experiences (for similar approaches see Mercea & Bastos, 2016). Our endeavour offers one of the first contributions on how individuals can self-organize actions that sustain long-term public service under conditions of financial strain, collapsing institutions and public provisions.

Background: The economic Crisis in Greece and the State of Civil Society

In 2010, the Greek government's decision to enter what was going to be the first of many economic adjustment programmes, committed the country to tough austerity measures. These led to a record rise in unemployment, a radical increase in poverty and homelessness levels, and a dramatic rise in suicide rates leading, as a consequence, to intense political turbulence, mass protests and civil disobedience (Henley, 2013). While the organization of protest is a routine characteristic of political life in Greece (Rüdig & Karyotis, 2013), community involvement and voluntary engagement rank among the lowest in Europe (Sotiropoulos, 2015). The intensification of the crisis, however, led to the gradual change of this picture. Countless informal self-organized initiatives and self-help groups spawned since 2010 seeking to help those mostly affected (Sotiropoulos, 2015, p. 3). Although new media played an important role in protest mobilizations at the time (Theocharis, 2016), the way in which these tools enabled citizens to organize solidarity and boost volunteerism remains unexplored, and so does its broader significance for understanding shifts in collective action organization.

Background: The Creation of #tutorpool

#tutorpool is but one of the many solidarity initiatives that emerged in Greece since the beginning of the financial crisis (Henley, 2012b). According to its creators[1], #tutorpool began on Twitter without previous organization in December 2011. The first step towards its creation was a tweet pointing out that many Greek families could no longer afford to pay the

[1] There are several accounts and interviews with the creators online, but for a summary see Henley (2012a).

tuition fees of their children's after-school tutorials, due to the belt-tightening that came along with the austerity policies[2]. The Twitter user prompted her followers with education degrees to offer free courses to students of vulnerable families and seek others in their neighbourhoods willing to do the same. The hahstag #tutorpool emerged from the discussion, and some people used it to declare courses they could teach, and in which areas.

In less than 24 hours the hashtag was trending first in the Greek twittersphere. With more and more volunteers declaring support and availability through the hashtag or personal messages, the user who sent the first tweet voiced the idea for creating a structured initiative and sought further tools for its implementation. She created and tweeted email accounts, and asked those interested to teach, or in helping her coordinate potential volunteers, to send emails. The response for both help and teaching was overwhelming. As a result, after three days a small group of users, which we will refer to as the core organizational team, met offline and decided to put the idea into action. The group agreed on a clearly defined code of conduct which prohibited any kind of financial profit or the promotion of views related to political parties. Members had to strictly adhere to the code. The core team's role became to implement the idea, manage the technical aspects and facilitate the meeting between tutors and families.

The core team used several online tools, the most prominent of which were (a) a Twitter account (@tutorpool), for announcing calls for volunteers, (b) a Facebook page, and (c) the website (www.tutorpool.gr) where parents and tutors registered in order to book courses. Interested teachers registered declaring the topic, the day/time of availability, and could mark on a map the area where they were willing to travel for teaching (see section 5 in supplementary material). All these details could be accessed from the registered families, who saw whether there was a tutor in their area offering the topic of their interest. If so, the parents activated an automated email to the tutors and their communication began without any other

[2] After-school support is essential for any student in Greece aiming to secure a place in higher education.

involvement from the rest of the #tutorpool members. It is only at that point that the full identities of both parts (child and its family/tutors) were revealed to one another. Both parents and teachers took full responsibility of this transaction in the best interest of the student, after accepting the terms and conditions of the initiative. This structure was formulated in order to protect both sides and, most importantly, to promote and ensure the self-organizing nature of the initiative for the years to come. In total, about a month after the initial tweet, the website was launched and the group's activities were in full swing with tutors conducting lessons in the students' homes or via Skype. According to the initiative's statistics, which were published on their Facebook page, in the three years that followed, more than 1500 tutors participated in #tutorpool, offline in neighbourhoods or online via Skype performing valuable public service and inspiring, in the process, similar – even state-supported - initiatives.

In all, one can identify three classes of #tutorpool members and supporters, the first two of which included members of the core organizational team who undertook the practical and technical necessities for the realization and maintenance of the initiative: (a) **online-offline volunteers-tutors:** those who helped in the initiative's organization and supported it online and who *also* taught offline; (b) **online-only volunteers**: a group of online users who helped spread the calls for volunteers via Twitter, and supported and spread the idea and the news of #tutorpool but *did not* teach offline, (c) **offline-only tutors:** those who learned about the initiative through word of mouth, email, or through conventional media and registered on the website as volunteers, but whose *sole* engagement with the initiative was teaching offline.

As can be clearly seen from this descriptive account, #tutorpool was an initiative which, from an organizational point of view, shape-shifted multiple times. It embedded innovative recruitment practices, combined organizational logics that stretched from highly crowd-enabled to institutionalized ones, and required participants with different skills who would be willing to play very diverse roles, some of which implied an unequal expenditure – but also

enjoyment - of personal and community resources. In many ways #tutorpool was a highly complex organizational construct whose success cannot be understood only through the examination of how the effective use of digital tools lowered participation and organization costs. Indeed, the most important empirical question is how communication patterns enabled the initiative's organizational structure to shape-shift so quickly and so radically within the map of collective action and how this affected its members' experiences.

Social Media and the Collective Action Space: #tutorpool's Evolution

Social media have been thought to have a transformative effect on the organization of collective action (Bennett & Segerberg, 2013; Earl & Kimport, 2011). At the crux of these theoretical accounts is the "conception of collective action as communicative in nature… insofar as it entails efforts by people to cross boundaries by expressing or acting on an individual (i.e. private) interest in a way that is observable to others (i.e. public)" (Flanagin et al., 2006, 32). This is an aspect of collective action that was previously given less attention but which has recently acquired new significance in Bennett and Segerberg's work on connective action, whereby the idea of "communication as organization" is the driving force behind understanding technology-enabled collective action. Perhaps the most interesting development of the influence of ICTs on collective action has been the melding of old (vertical) with new (horizontal) forms of collective action that lead to collective actions with highly differentiated modes of involvement by its participants. According to Flanagin et al (2006) collective actions can be thought of, and arrayed orthogonally, as exhibiting variation along two independent and fundamentally communication-based dimensions: (a) the mode of *interaction* used (ranging from personal to impersonal) and (b) the mode of engagement felt among participants in these efforts (ranging from entrepreneurial to institutional).

The stages of #tutorpool's evolution are sufficiently clear theoretically, but network dynamics are complex process that raise interesting empirical questions about communicative

interactions. Although there are different ways to think about collective action, Flanagin and colleagues' (2006) framework (adapted for the purposes of this study in Figure 1) is a theoretically fertile way to account for its communicative aspect. The reason is that, by viewing groups in terms of these two axes (interaction and engagement), the emphasis is placed on the ways in which personal relations and various activities are enacted by members or, in other words, in what people do and how they communicate, and not solely on organizational structures (Bimber et al., 2012, p. 96). Bennett and Segerberg (2013, pp. 6–7) note that one of their core points of departure for understanding collective action is that citizens seek more flexible association with causes, ideas and political organizations, and are keen on adopting personal action frames. A key characteristic of collective action in the contemporary environment, thus, is that form is more flexible and can be adapted to fit context (Bennett & Segerberg, 2012; Chadwick, 2007; Flanagin et al., 2006).

Most importantly, as it will become clear from our own observations about #tutorpool's diverse membership base (in terms of the ways in which individuals choose to perform their role as members of the organization, how they relate to one another, and what opportunities are afforded them in the process), what the organization *means* may vary across classes of members. As Bennett and Segerberg note (2013, p. 13), in connective action organizations and groups have various degrees of internal cohesion as members are increasingly likely to pursue a personal path to engagement. This results in different engagement experiences and, as we will show in the case of #tutorpool, different levels – and recipients - of commitment. We find that although there is a clear affective relationship with #tutorpool across its entire membership base, this does not necessarily translate to uniform sentiment of community attachment to the organization. It rather appears that, outside the heavily committed core group of organizers, members' commitment is primarily attached to the specific role they have to fulfil. Therefore, instead of focusing on organizational structures as the chief shapers

of members' behaviour, this framework entices us to look the other way around, emphasising how the structure of collective action is itself driven by individuals' flexible and personalized conception of membership.

[Figure 1 around here]

Phase 1: Emergence Through Connective Action

The birth of #tutorpool through the widely-shared tweet that started a conversation among interested but previously unknown to each other individuals is an textbook example of what Bennett and Segerberg (2013) call connective action. It is plausible that, after repeated interaction with one another, the core group members developed interpersonal relations and potentially strong ties. As such the engagement with the initiative experienced by this class of members involved diverse opportunities for participation, and was accompanied by different levels of responsibility and contribution. These are all entrepreneurial elements which locate #tutorpool's emergence in quadrant II of the collective action space (Figure 1). More substantially, it was Twitter's technological affordances that enabled these individuals to meet online in the first place, helping them form a core group of interested volunteers. Although theoretically plausible, it is hard to imagine how exactly a group of decentralized individuals with such a diverse skillset and willingness to volunteer could have come together so fast, inexpensively, and with so few coordination costs shape the idea and set the rules for a highly complex initiative (and succeed in making it work in a single month). From an empirical point of view, the intense online exchanges – which were initially and continuously based on Twitter – that brought these individuals together and allowed this entrepreneurial mode of engagement, should be reflected in the structure of communication around #tutorpool. We thus hypothesize that: **(H1)** The #tutorpool network's communication structure had initially a highly dense structure, pointing towards the development of strong communicative ties between core members.

Phase 2: Institutionalization and Recruitment

The core team took immediate steps towards a more institutionalized and rationalized structure, a not inevitable but hardly surprising development (Aldrich, 1979). Building a website in which potential tutors could register, creating a database of volunteers and families in different locations and, most importantly, creating a strict code of conduct that is publicly available, marks a transition toward the kind of institutional mode of action that is characteristic of quadrant III (Figure 1). It is a kind of collective action that involves a set of normative rules of engagement prescribed by an official leadership team, as well as practices that have to be followed (Flanagin et al., 2006, 37), and points towards the establishment of a more closed group that sets the rules of the game (see also Shaw & Hill, 2014).

Once the recruitment structures were ready to accommodate volunteers, establishing communication patterns that could push the call for volunteers as far across users' networks as possible became the initiative's top priority. Hundreds of messages were posted on Twitter about children in need of tutoring, and were subsequently retweeted. This aspect of online recruitment means that, from a collective action organization point of view, along with retaining its institutional seat in quadrant III, #tutorpool also occupied a place within the two entrepreneurial quadrants (I and II). Anyone who heard about the initiative on Twitter or any online-only volunteer with an interest in it, unconstrained by any organizational boundaries and completely unknown to the organizing team, could help get its call for volunteers across the network by retweeing @tutorpool's calls for volunteers. Extant research has indeed stressed the importance of the casual, small-time (Earl & Kimport, 2011; Mercea, 2014) engagement of such "peripheral" participants (individuals who represent the diminishing online activity around committed minorities within the network) in increasing the reach of tweeted material (Barberá et al., 2015). From an empirical point of view this should be reflected in the communication around #tutorpool: **(H2)** #tutorpool's communication network

will, across time, display higher levels of bridging structures, pointing towards an attitude of reaching outside the more closed core group, and establishing bridging ties. At the same time, it is sensible to also hypothesize that the empirical reality will also reflect that only a small group of highly engaged with the initiative accounts will have the monopoly in crafting and distributing calls for volunteers on Twitter. This implies that these users would be highly active as producers and recipients of information, as well as information brokers that have greater capacity to bridge structural holes (than the average retweeterer) which could hamper information diffusion (González-Bailón & Wang, 2015, p. 102). We thus hypothesize that **(H3)** a core group of core user-organizers played a pivotal role in producing, receiving and brokering information across time.

Phase 3: Public Service and Community Building

The third and last (ongoing) phase of the initiative saw #tutorpool volunteers begin to teach children in every corner of Greece, offering invaluable public service. Crucially, an important subset of the initiative's volunteer base, namely the offline-only tutors, not only simply conform to the institutional boundaries set by the core group but also remain largely unknown to each other in spite of their shared affiliation as tutors. This reflects a type of engagement that locates their action in quadrant IV (institutional/impersonal) (Figure 1). These volunteers retain only impersonal contact with the core team, and the whole initiative in general, via email or through the website. This leaves them with very few opportunities for developing strong ties with other members and feelings about the initiative that could provide a basis for sustaining its production of public goods and developing a committed pool of volunteers.

This important aspect of #tutorpool's organizational structure implies that its transition (as depicted in Figure 1) across and within quadrants in which different classes of members experience different modes of engagement and interaction, should have consequences for the way different classes of participants experience their engagement with the initiative. The level

of attachment to what can be thought of as "the #tutorpool community" can help us observe these variations. For example, those online-only volunteers and online-offline volunteers-tutors of quadrants II and III should, due to the closer and more frequent online interaction with each other, be more likely to develop a sentiment of attachment to the initiative that is much stronger to that of the offline-only tutors who are engaged in quadrant IV and who experience very weak or no ties. Literature has shown that the online realm can be a fertile place for further developing existing social ties and establishing new, community ties (Ellison, Steinfield, & Lampe, 2007; Gruzd, Wellman, & Takhteyev, 2011). This leaves open the possibility that typical features of community such as a sense of membership, a feeling of integration and a shared emotional connection (McMillan & Chavis, 1986) could be developed among participants. All these features are very valuable bonding resources as they may contribute to loyalty and long-term commitment to a group's cause -- an aspect that some have argued comes in short supply in technology-enabled movements (Gladwell, 2010). There is thus a very important point to be made here about how an individual's position in the #tutorpool network may define her attachment to the initiative, and what consequences this relationship may have for the initiative more broadly. In his discussion of participatory civics, Zuckerman (2014, p. 162), building on Hirschmann's *Exit, Voice and Loyalty* (1970), stresses how loyalty to an organization can provide the basis for its long-term survival, especially in difficult times when members are disappointed with it (Hirschmann even argues that individuals can raise their voice and persuade the organization to change its path). Sense of attachment to organizations with very flexible organizational structures, like #tutorpool, may thus turn out to be an extremely important aspect that safeguards its existence, but which may not be equally distributed among its multi-layered membership base. Indeed, considering the division between classes of participants, it is plausible to think that, due to different engagement experiences, attachment to the initiative was a resource from which participants

who remained unknown to one another (the offline-only tutors) were deprived from. In hypothesis form, **(H4)** offline-only tutors should display significantly lower levels of community attachment to #tutorpool when compared to the rest of the initiative's participants.

Data & Methodology

Network Data and Metrics

Testing the four hypotheses put forward above implies two sources of data: (a) data at the network level that enable us to study the communicative structure of collective action in a dynamic fashion, and (b) data at the individual level that can provide information about the experiences of different classes of #tutorpool participants. In order to examine #tutorpool's communication network as it went through different phases, we use Twitter data from December 2011, and thus from day one of its appearance on Twitter, and for the next 6 months. The data (N = 4,760 tweets) were collected using Twitter's public API using the term "#tutorpool". We took every tweet that contained this hashtag, and filtered out those that did not contain a mention, a "RT" or a "via" (i.e. @) to another user. With the remaining tweets we created an edge list of senders and receivers, and constructed monthly networks. All the tweets from a given month represent a static network with a set number of vertices and edges. Figure 2 shows the distribution of edges and vertices (and, as such, the size of the networks) for each month, with a clear specification of the different phases of the network.

[Figure 2 about here]

To answer the hypotheses focused on the network level (i.e. H1- H3) we need different types of information. First, we need a method for detecting how fragmented the #tutorpool network was. To this end we conducted a maximal clique census. By identifying cliques that are not themselves subsets of larger cliques, this type of census allows us to see how many fragmented components – and of what size - the network consists of, once it is broken down, and thus to detect which of the smaller components contain actors that are particularly

influential for the brokering and flow of information. Second, we need a metric for measuring not only the most important brokers in the network, but also their role in spreading information. To this end we use *betweenness centrality* which considers the overall network structure in relation to a vertex's position, and calculates how many times a vertex sits on the shortest path (known as "geodesic") linking two other vertices. We also calculate *edge betweenness centrality*, which considers the number of the shortest paths that go through an edge in a graph or network, to verify that the actors with the highest betweenness score are also those most important for the spread of information. Finally, if the organizational logic follows a pattern of diffusion and not, say, mutual exchanges, the information flow should be rather one-directional than reciprocal. As our Twitter network is set up as a network of tweet exchanges or retweets between Twitter users, looking at the *network reciprocity metric* allows us to establish the proportion of pairs of actors that have a reciprocated, or a one-directional, tie between them. In other words, it allows us to establish whether the emphasis is on information diffusion from the centre to the periphery.

To understand the formation of structural signatures such as bridging (H2) and bonding (H1) ties, we follow Burt's (2005) approach, and use his main metric for brokerage or the presence of bridging ties: *network constraint index.* To measure bonding, we depart from Burt and use a different metric, *network modularity.* Constraint represents the ability of any given member of the network to access other members of it. A higher level of individual constraint means that the member depends more on others to access the rest of the network. Since constraint is measured from zero to one, a score of one represents no brokerage, while zero represents full brokerage. We then average the individual levels across the network. Unlike constraint, modularity is measured at the network level and ranges from -0.5 to 1, where positive numbers reflect the presence of dense groups within the network and lack of connections between them. In particular, in order to identify correctly the membership of each node to one

or more dense groups, we use the random walks algorithm. This procedure assumes that shorter paths between the nodes denote the presence of denser groups within the networks. Both indicators have been used in the literature (Bianconi, Darst, Iacovacci, & Gortunato, 2014; Sajuria, VanHeerde-Hudson, Hudson, Dasandi, & Theocharis, 2015; Shen, Monge, & Williams, 2014) as a way to assess the presence of bonding and bridging ties.

In order to provide empirical tests for the observed levels of brokerage and closure (H2 and H1), we have used network simulation as a baseline. In particular, we have estimated random networks to compare with each of our static monthly networks. This procedure follows the Configuration Model (Bender & Canfield, 1978; Molloy & Reed, 1995) for random networks. This method is an extension of the traditional approaches to random graphs (i.e. Erdos-Renyi) in the sense that, on top of estimating random networks with the same numbers of nodes and ties, it also takes into account the degree distribution of the real networks. For each month, we estimated 1,000 simulations based on the observed networks. This allows for a realistic set of random structures that do not follow traditional attachment patterns. For H1, H2 we calculate the average constraint and modularity coefficients across each group of 1,000 simulations, and compare them to our observed networks. We use this approach to produce a random benchmark which, in turn, approximates a traditional test against a null hypothesis. Around each estimation and where possible, we produce a 95% confidence interval.

Individual Level Data and Measures

Our second source of data originates in a short survey distributed to #tutorpool volunteers by one of the authors of this study who was personally involved in #tutorpool from its beginning, in July 2013 -- and thus when the initiative's activities have already been established for two years. Using the initiative's database, we emailed a questionnaire to all #tutopool registered tutors, which at that time amounted to 802. Importantly, this means that we were granted access to all three different classes of participants mentioned earlier. The questionnaire, which

addressed three different topics - political and civic participation and attitudes, attachment to the #tutorpool community and demographics (including social media use) - remained online until August 2013 and two reminders were sent regarding its completion. It was filled out by 159 volunteers; that is, 20% of the registered #tutorpool tutors at the time, and included all members of the organizing team. Although we cannot exclude the possibility of self-selection bias, the demographic characteristics of the tutors who filled in the questionnaire were almost identical to the ones found on #tutorpool's online registry (see section 4 in the supplementary material), and thus the sample is fairly representative of the #tutorpool volunteers.

We measured sense of community by adapting the battery developed by McMillan and Chavis (1986) to the #tutorpool context (for the full list of items see supplementary material). Four of the questions were considered in the analysis as indicators of community attachment. Item factor analysis for categorical data was employed (in MPLUS) to confirm this hypothesis. The unidimensional model that included all items had close fit to the data (chi-square=2.852, df=2, p=0.240; RMSEA=0.052, CFI=0.997). Therefore the factor (labelled as community attachment index (CAI)) scores were employed in subsequent analysis to summarize the information provided by the responses in the four items. Using one-way ANOVA tests, we searched for significant differences between our index and the participants' SES, as well as between our index and a number of initiative-specific items aimed at capturing members' past community involvement and, most crucially, *interaction* with other members of the community. These included how much time the participant had spent with other #tutorpool members online and in person (offline), how much usage they had made of different social media platforms, and how did they first hear about #tutorpool.

Results

Organizational Logic and Brokerage in the #tutorpool Network

As a way to structure the discussion of the results, it would be useful to reiterate the hypotheses we are testing, namely,

H1. The #tutorpool network's communication structure had initially a highly dense structure, pointing towards the development of strong communicative ties between core members.

H2. #tutorpool's communication network will, across time, display higher levels of bridging structures, pointing towards an attitude of reaching outside the more closed core group, and establishing bridging ties.

H3. A core group of core user-organizers played a pivotal role in producing, receiving and brokering information across time

In line with H1, extant research shows that most online networks are often organized around structural holes that prevent the diffusion of information (González-Bailón & Wang, 2015). #tutorpool's network was no different. As H1 comprises two different elements – the presence of a dense network structure, and a group of core members - we use a dual approach to test it. First, we look at the full network (that is, all the vertices and edges over 6 months) in the search of connected components. Our analysis shows that the network is formed by a single weakly connected component, and that the number of strongly connected components is rather high (18, see Table 1). These results show the presence of a large number of densely connected groups. Along with this connected component census, the positive scores for modularity at all stages of the network show that this was a fragmented network with densely connected groups. These results point towards the confirmation of the first part of H1, showing the presence of a dense structure in the network. The next step was to identify the presence of a core group. In order to assess their presence and composition, we use betweeneess centrality (BC). The distribution of BC (the distribution of betweenness centrality across time is available in the supplementary material) shoes a skewed distribution with only a small number of users with the highest betweenness, as well as most influential

dyads for information diffusion. Computing the value for the edges with the top 5 highest edge betweenness centrality resulted in the following pattern:

1. @sat[…] → @dol[…] ; **2. @tutorpool → @dol[…]; 3. @dol[…] → @har[…]**

4.@tutorpool→ @aet[…]; 5. @gal[…] **→ @tutorpool**

This result confirms H3, namely that a minority of highly committed users (in this case a team composed of @dol[…], @sat[…], @har[…], @aet[…] and @tutorpool), played a significant role in generating and brokering information to the network[3].

Although the above results are based on the aggregate six-month data, the same group – with minor changes in vertex order - appears to be the one mostly active in information brokering also when the network is broken down into six single-month periods, lending support to the idea that this tightly connected group of #tutorpool users found above were indeed the chief diffusers of information within the network. Table 1 offers a summary of the most important network characteristics and Figure 3 provides further evidence by showing the betweenness centrality of these top 5 users over time in comparison to the average score for the entire network. As a way of standardization, we use the average as a benchmark and focus on the standard deviations from the mean (i.e. *z-scores).* We find a pattern similar to the one found in recent studies on the use of social media for the organization of protest campaigns, whereby the large majority of users surround a small epicenter of protests, displaying less (but highly critical for efficient information distribution) online activity around the committed minority (Barberá et al. 2015). In Figure 3, most of the core users of the network show a consistent higher betweenness centrality than the average. Some exceptions represent the @tutorpool account, which only moved to the top during the second month, while @dol, who first tweeted about the #tutorpool idea, remains central across the 6 months under study. This

[3] After contacting the #tutorpool team we verified that all five accounts identified above were members of the core team. To retain the users' anonymity, only the first three characters of their Twitter handles are printed.

result also confirms H1's statement that the dense structure of the network is linked to the development of communicative links within the core members of the network.

[Figure 3 about here]

The evidence presented above is indicative of the organizing group's success in diffusing the message away from the core of the network (the network diameter was 7 – a relatively high number for a network of #tutorpool's size), and of the importance of the large numbers of less committed "messenger" type of users whose retweeting helped the message travel across the network. Our final measure, network reciprocity, had a pooled value of 0,012 which is very low. The information this measure conveys is in line with our expectations that connectivity within the network was mainly one-directional. Once put forward, the hashtag was used predominantly for mentioning others, or for retweeting. This is in line with the idea of how information diffusion for recruitment was supposed to take place on #tutorpool's Twitter network once a tweet with a call for volunteers appeared. Interactive replies were much less the focus. Confirming H3, our results indicate that, from a communicative point of view, the organizational logic of Twitter-born civic networks has similarities with protest networks.

In order to test H2, our analysis allows us to further disentangle the network's diffusion practices. We first establish a baseline – i.e. that the #tutorpool network has *some* structure – and then we investigate the levels of closure and brokerage across time in relation to random simulations. As Figure 4 illustrates, the observed networks show clear differences to the random simulation, which was to be expected. The observed levels of modularity are higher than the results from the configuration model for most of the time, which is an indication that the core members of #tutorpool's Twitter community were interested in forming a tight group and sustaining it over time. This confirms H1 and shows that the members of the core group

were successful in keeping a cohesive group, a finding that, as we shown below, can be linked to our individual-level analysis which shows that individuals who had spent time interacting with other members of the #tutorpool initiative online were also more likely to feel greater levels of attachment to the #tutorpool community. At the same time, however, Figure 3 shows that the levels of brokerage remain mostly consistent throughout the examined time-frame, yet in February, and later in May, they are higher than the random simulations (constraint has an inverse relationship to brokerage, as such, high levels of constraint reflect lower levels of brokerage). We interpret this as evidence that the network also put effort in reaching outside the closed group establishing bridging ties, and that it succeeded at a certain point in time - supporting H2. Moreover, when the network becomes much smaller (i.e. the last month), and only due to the size, we could expect that the levels of brokerage could get smaller. However, the #tutorpool network shows the opposite trend.

[Figure 4 about here]

For the size of the networks, these results seem slightly surprising. The higher levels of closure at the beginning of the network reflect that the initial impulse of the initiative came from the core group of organizers, but the high brokerage at the same time shows that they were consistently aiming to distribute the information outside their inner network – consistent with the purpose of the initiative. Over time, the influence of the central nodes remains – as evident also from the consistently high betweenness centrality measures which is perhaps an indication from the network perspective of the higher levels of attachment to the initiative we show below to characterise those who spent time online with other members of the initiative, while the levels of bridging ties become significantly different than random. Our interpretation is that the bridging ties started to build up as more people learned about the initiative on Twitter and joined the conversation. We caution that an alternative interpretation may be that, as the network dense groups slowly dismantled the members of the central

groups remained the only brokers among the dispersed peripheral clusters, thus increasing the value of brokerage, in which case our argument for an outwards development – as opposed to a structural effect – would be weaken. The overall analysis, however, does support the idea that this was an outward-looking network with the objective of diffusing information to achieve the highest possible recruitment. The combined presence of high modularity and brokerage, along with a cohesive core over time and low levels of reciprocity, all point towards this direction.

#Tutorpool Volunteers' Participatory Experience

How did #tutorpool members with different levels of engagement with the initiative and interaction with others experienced their participation? Focusing on community attachment and personal interaction, our hypothesis is that offline-only tutors would display significantly lower levels of community attachment to the initiative when compared to members who engaged with the community online and who came into contact with other members.

It is helpful to report some descriptive information about the background of #tutorpool members who filled the survey against the general population of Greece. Representative data from the latest wave of the European Social Survey were used for these comparisons. #Tutorpool had a significantly higher percentage of women (67.5% versus 55.9% respectively, χ^2=7.156, df=1, p=0.007), and its members were more highly educated when it came to Master's and PhD degrees (Msc: 34.4 % versus 8.4% and PhD: 15% versus 1.5% respectively, Bonferroni adjusted p<0.05 in both cases), and younger than the general population (χ^2=31.254, df=1, p<0.001)**.** The percentage of unemployed members (23%) is clearly higher than the general level of unemployment in the country at that time (15.8%) -- based on the Hellenic Statistical Authority. No significant differences were found between those who had previously engaged with civic organizations and those who did not. Clearly #tutorpool activated a young and highly educated segment of the population that had little or

no job security. One could argue that it was exactly because of many people being unemployed (and potentially having more time) that they were able to invest personal resources to #tutorpool, subsequently developing an attachment to the initiative. Yet, based on our ANOVA tests no significant differences were found between all these socio-demographic variables in relation to feelings of community attachment to #tutorpool.

Our further ANOVA tests confirm our hypothesis (H4) that offline-only tutors should display significantly lower levels of community attachment to #tutorpool when compared to the rest of the initiative's participants. We find significant differences in the mean CAI between those who have spent time with other members of the tutorpool initiative online ($F(1,156)=11.452$, $p=0.001$) and offline ($F(1,150)=8.634$, $p=0.004$), and those who did not (all plots are available in the supplementary material). Overall, having spent more time online and/or offline with other #tutorpool members corresponds to a higher level of attachment to the #tutorpool community. The picture emerging is in line with our theoretical expectations. There is a division in the experiences in relation to the initiative as a community between (a) people who did not interact ("spent time") with other #tutorpool members online or offline, and generally engaged in a rather institutional way (i.e. those who only registered their personal data and expertise and going ahead to teach), and (b) people who spent time with other members online or offline, and engaged in a more entrepreneurial way with the initiative that also involved closer interaction with others.

Although our descriptive statistics show that the vast majority of tutors felt close to the initiative (77% of our sample stated that they "feel as part of the #tutorpool community"), group (b), as we saw, scored significantly higher in level of attachment to the community. Those who interacted with others for the organization and coordination of the initiative, felt closer to it than those who have little to do with its organizational aspect and whose membership focused only on teaching offline. This creates an interesting division in terms of

how invested different classes of the initiative's members were in it. Presumably, the offline-only tutors felt that this was a worthy endeavour that they ought to support, and did exactly what they deemed to be the best way of supporting it: taught children voluntarily, but without meddling in the organizational work. This implies identifying with the initiative and its goals, but investing most of one's personal resources with the child and the family. The kind of weak or strong ties that tutors could subsequently develop with the family and the child is an extremely important aspect of the social capital-building that #tutorpool may have motivated *outside* its own organizational auspices. We were unable to capture this aspect in our survey but we think it is an important by-product of such organizations that should be studied further.

Finally, our tests related to the different ways in which our participants learned about #tutorpool prior to engaging with it, show that those who learned about its existence through social media had a higher level of attachment to the initiative ($F(3,152)=3.208$, $p<0.001$). Post hoc tests (Bonferroni adjustments for multiple comparisons) revealed that those who learned about the initiative via Twitter are the ones with the highest mean community attachment scores. This too corroborates our theoretical expectations, as well as the results of the network analysis, by highlighting the important role of technology for bringing people together and shaping the community itself, as well as the members' experiences.

Discussion

Extant literature has largely overlooked the use of social media for volunteering and the provision of public services. Yet such use has become increasingly widespread and important over the past few years. Our study finds that Twitter can provide a space in which individuals without previous knowledge of one another can establish efficient networked communication ties for the long-term, sustained organization and coordination of voluntary action. This is an important contribution to a literature that has so far been overwhelmingly focused on protest mobilization. We show that #tutorpool was led by a core team of brokers-organizers who used

digital technology to set up and coordinate the activities of hundreds of decentralized individuals willing to teach voluntarily children in their neighbourhoods or online from afar. These brokers occupied key positions in the network that evolved on Twitter and were able to moderate and channel the information flow across networks maximizing recruitment.

Although #tutorpool is but one example of a solidarity initiative, our empirical endeavour produces insights that we think are relevant for other civil society initiatives powered by digital media. Digital media communication can bring together decentralized and potentially disparate individuals around a common cause – an aspect similar to how digital media are used to organize large-scale protest events, such as *Occupy*, today. Personal interaction at that level may provide individuals with opportunities to shape an agenda for the collective action effort. The immediate next step, however, seems to be radically different than in many digitally-enabled protests. Solidarity initiatives such as #tutorpool have a clear goal ahead of them whose solution often does not have to wait for policy attention, but can be tackled immediately through voluntary action. In this way, and as opposed to protest groups which have to pin down long-term objectives (e.g. inequality in the case of *Occupy*), meddle over their ideological consistency, and find ways to pressure political actors, voluntary initiatives can (and must) come up with an organizational structure that will help accomplish their goal immediately. #tutorpool achieved this by creating formal organizational structures which involved clear rules that had to be respected, and by recruiting people who would support the initiative and who could offer a specific skillset without which the initiative couldn't provide public services. Such voluntary initiatives differ from some crowd-enabled protest networks such as *Occupy* (Bennett & Segerberg, 2013) which often resist the transition to formal structures of organization (Calhoun, 2013), are unable to perform important tasks often performed by institutionalized structures (Kreiss, Finn, & Turner, 2011) and, as a consequence, eventually dismantle. That there was a core of dedicated organizers who

carefully orchestrated the distribution of the #tutorpool idea, shows that in the case of #tutorpool organization was more akin to hierarchical logics seen in digital media-enabled collective endeavours as diverse as the Arab Spring protests organization in Egypt (Howard & Hussain, 2011, p. 48), and the ways in which peer-production communities sometimes operate (Shaw & Hill, 2014, p. 229). In this sense #tutorpool provides an important example of how digital media enable individuals to create and, most importantly, *sustain* across time digital initiatives with formal organizational structures.

The rapid shape-shifting from a crowd-enabled initiative to an institutional construct meant that the project combined three different organizational characteristics. First, a core decision-making team which operated beyond physical space (there were no central offices) and which was heavily invested on the initiative. Its members interacted with one another online - and in few occasions offline - and felt strongly emotionally attached to the initiative. Second, a body of online supporters who were critical for the recruitment effort – a role similar to that played by the diminishing online activity of peripheral participants observed in protest networks (Barberá et al., 2015). Third, a base of spatially distributed offline local volunteers -- the lifeblood of the initiative - who, despite their critical role and responsibilities, were otherwise uncoordinated and left to their own devices once they made contact with the family.

Thinking about the importance of commitment for the long-term sustenance of organizations, we observe with interest that attachment to the initiative was not uniform among the different classes of members, and depended on one's position in the overall #tutorpool network. Despite their affective relationship with the initiative, offline volunteers were less invested with the initiative as a community, but probably very invested with the child they undertook. This stresses the idea that, outside the core group, commitment took a different form, relating to the specific role that members had to fulfil. It is thus not unreasonable to assume that, although #tutorpool's operational logic will not change as time passes by, attachment and

loyalty to the initiative may - in the long run – wane, as the tutor and the child move slowly away from the initiative and into the family nucleus in which another form of attachment and loyalty is built. This presents us with an interesting situation in which waning attachment to the initiative *does not* result in the organization "losing" in collective action terms. Rather, we observe the (successful) creation of the conditions for a certain class of members whose role does not afford them much attachment to the initiative, to build loyalty with those they are supposed to help. In instrumental terms, therefore, the organization appears to be highly successful in achieving its purpose. An additional related lesson learned here, which also distinguishes this case from those of protest mobilization, is that technology in these types of actions may play an important role, not only in organizing action but, crucially, in creating alternative reward schemes away from market-based ones – much as the ones discussed by Benkler (2006, p. 6) - that different types of participants can strive for. Such digitally-enabled initiatives may thus tap a form of societal resource-creation that becomes available in the form of helping those who have an immediate need for it (in this case the students), but also in the form of fulfilling community or participatory needs (see also Benkler, 2006).

The structural complexity of #tutorpool is a compelling example of how organizational structures can emerge with the use of digital technology. Although entrepreneurial engagement has existed before – and, indeed, arose in other types of initiatives in Greece during this time of crisis, the use of technology makes #tutorpool a different undertaking in terms of how fast it moved across – while simultaneously coexisting in (Chadwick, 2007) - multiple quadrants of the collective action space (Flanagin et al., 2006) shaping, in the process, collective action dynamics that offer a variety of opportunities for interaction and engagement. Remarkably for an initiative with zero financial resources, #tutorpool was able to take up organizational forms that could integrate participants with very different functional attachment and potential for resource accumulation to the whole endeavour.

Our findings are important when considering the broader consequences of digital technology use for voluntary action organization. First, although #tutorpool is used here as an illustrative case, it reflects an intertwinement of using digital technology and organizing social life that may become increasingly common in the coming years. Using digital technology to pool educational resources is just one expression of the deeper phenomenon of state's withdrawal from the welfare sector. This phenomenon is neither exclusive to Greece, nor particular to financial crises. It can be encountered in other cases where institutions are faltering. In response to it, ordinary people may find the use of digital technologies as a meaningful way to become participants, rather than spectators or complainers - invoking Evans' and Boyte's work on "free spaces" (1992) – in the complex, ambiguous and engaging processes and conversations about democracy and participation in public life. Indeed, as Wells (2014, p. 213) perceptively notes elsewhere it could be that "this approach to activism is not a product of technology—in fact, it may be the reverse: the technology that we know and love may be the product of this mentality".

Second, although #tutorpool assembled a diverse set of volunteers and organized them into achieving a very specific goal, tutors had to subsequently make the major step of integrating themselves within the personal and social world of the child they undertook to teach (often for more than one year). This implied building trust not only with the child itself but also with its family, thus potentially enabling a process of social capital generation within the family. This new phase – which we are not able to capture in a study that focuses only on a particular (mainly communicative) subset of #tutorpool's institutional existence and social ramifications - could become the point of departure for those involved to establish more trustful relationships with others in the future. There is a strong case to be made about the potential of digital technology towards the generation of not only particularized and initiative-specific, but also *generalized* trust – the most difficult form of trust to create in adult people (Freitag &

Traunmueller, 2009). The ramifications of such initiatives, especially for countries where volunteering is scarce and civil society weak or underdeveloped, are significant.

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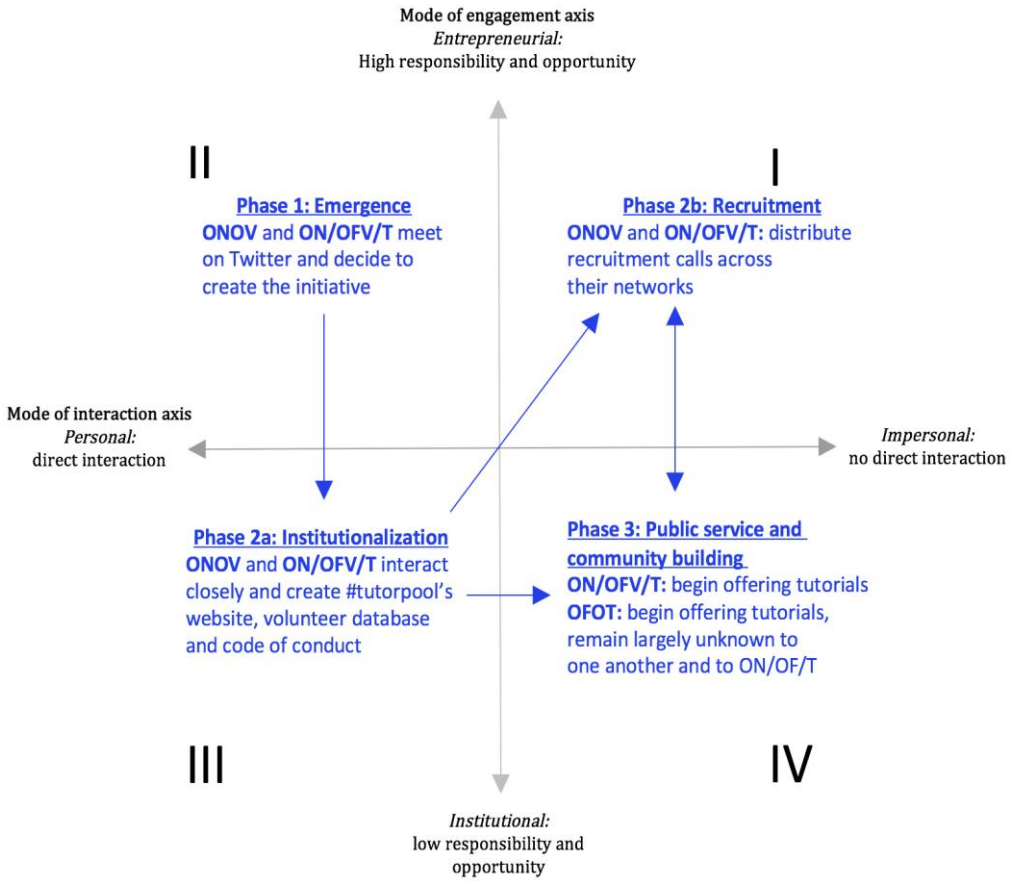

Figure 1: #tutorpool's transition on the collective action space (Figure adapted from Flanagin et al 2006, p.34). *Note:* The arrows reflect the initiative's temporal order in its movement across the collective action map. *Acronyms*: ONOV = Online-only volunteers; ON/OFV/T = Online-offline volunteer-tutors; OFOT = Offline-only tutors.

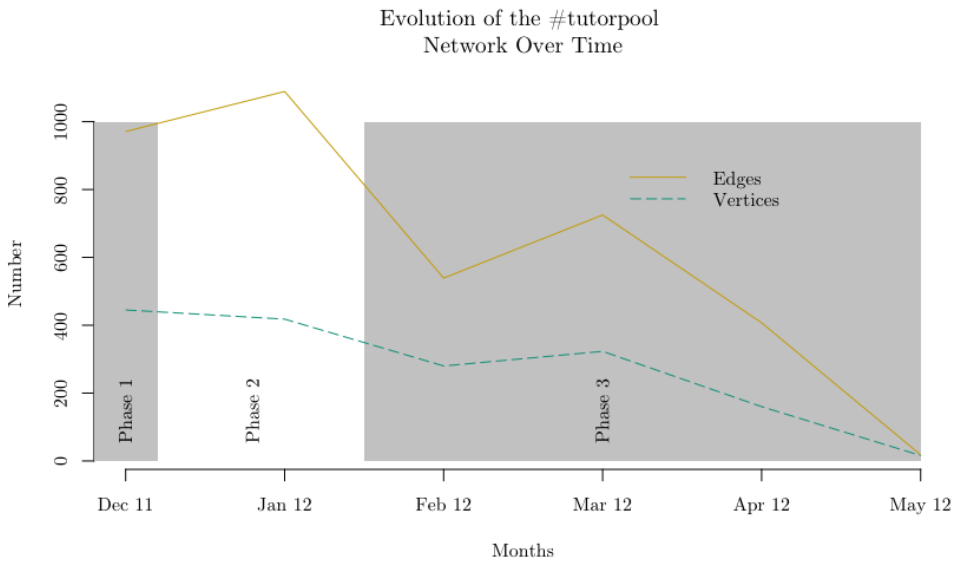

Figure 2: Evolution of the #tutorpool network from the beginning of the initiative in December 2001

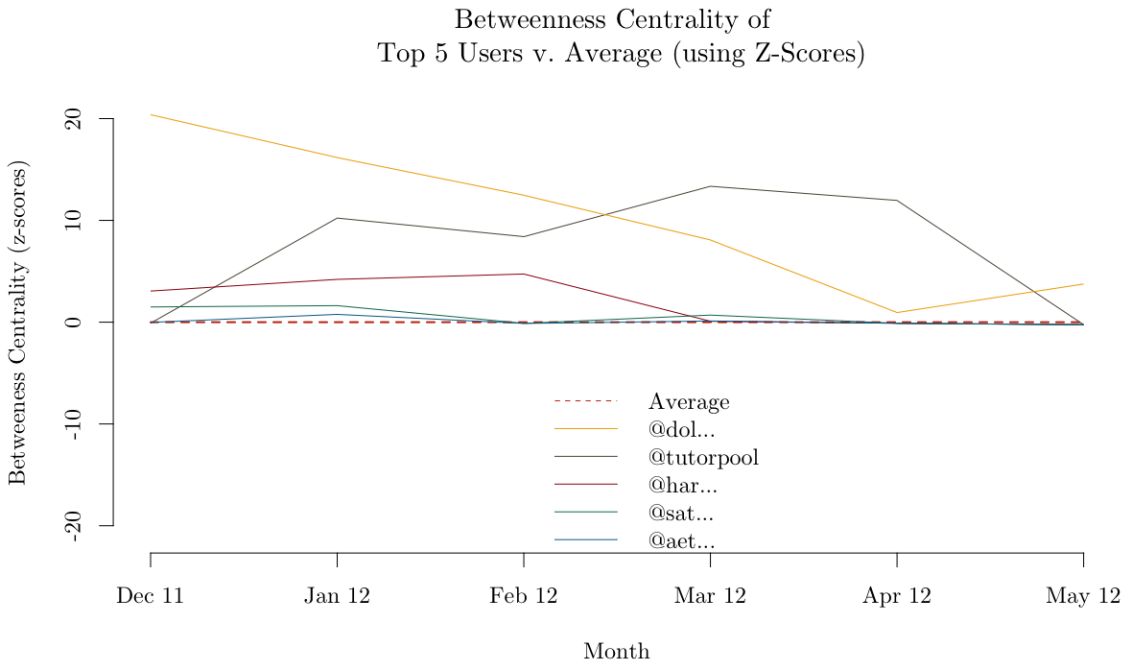

Figure 3: Betweenness of the #tutorpool core group in relation to the monthly averages

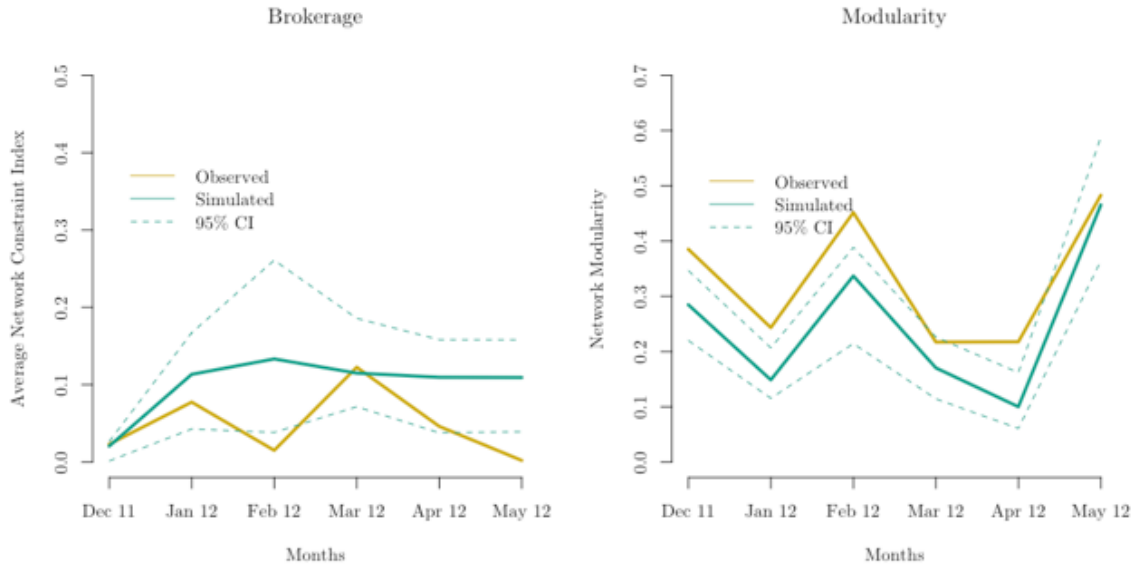

Figure 4: Comparison of closure and brokerage between observed and simulated networks

Network Metrics	Dec. 2011	Jan. 2012	Feb. 2012	Mar. 2012	Apr. 2012	May 2012	Total
Vertices	445	418	280	323	160	16	1166
Edges	971	1089	539	725	407	18	3087
Network diameter	7	6	6	6	4	2	7
Maximum indegree	319	261	263	501	316	8	438
Maximum outdegree	77	80	23	45	58	3	79
Average degree	4.4	5.2	3.9	4.5	5.1	2.3	1,8
Average clustering coefficient	0.5	0.6	0.7	0.8	0.7	0.3	0,166
Reciprocity	0.08	0.11	0.04	0.03	0.01	0.00	0,012
Modularity	0.4	0.2	0.5	0.2	0.2	0.5	0,341
Strongly Connected Components	12	9	7	5	3	3	18

Size of largest component	421	400	267	311	156	11	1039
Proportion of nodes remaining from first cohort	100%	33%	23%	22%	13%	2%	N/A

Table 1: Main characteristics of #tutorpool network over time (Dec 2011 – May 2012)